Aug. 29, 1939. A. HENDERSON 2,171,338

BUILDING MEMBER AND CONSTRUCTION

Filed Sept. 29, 1938 5 Sheets-Sheet 1

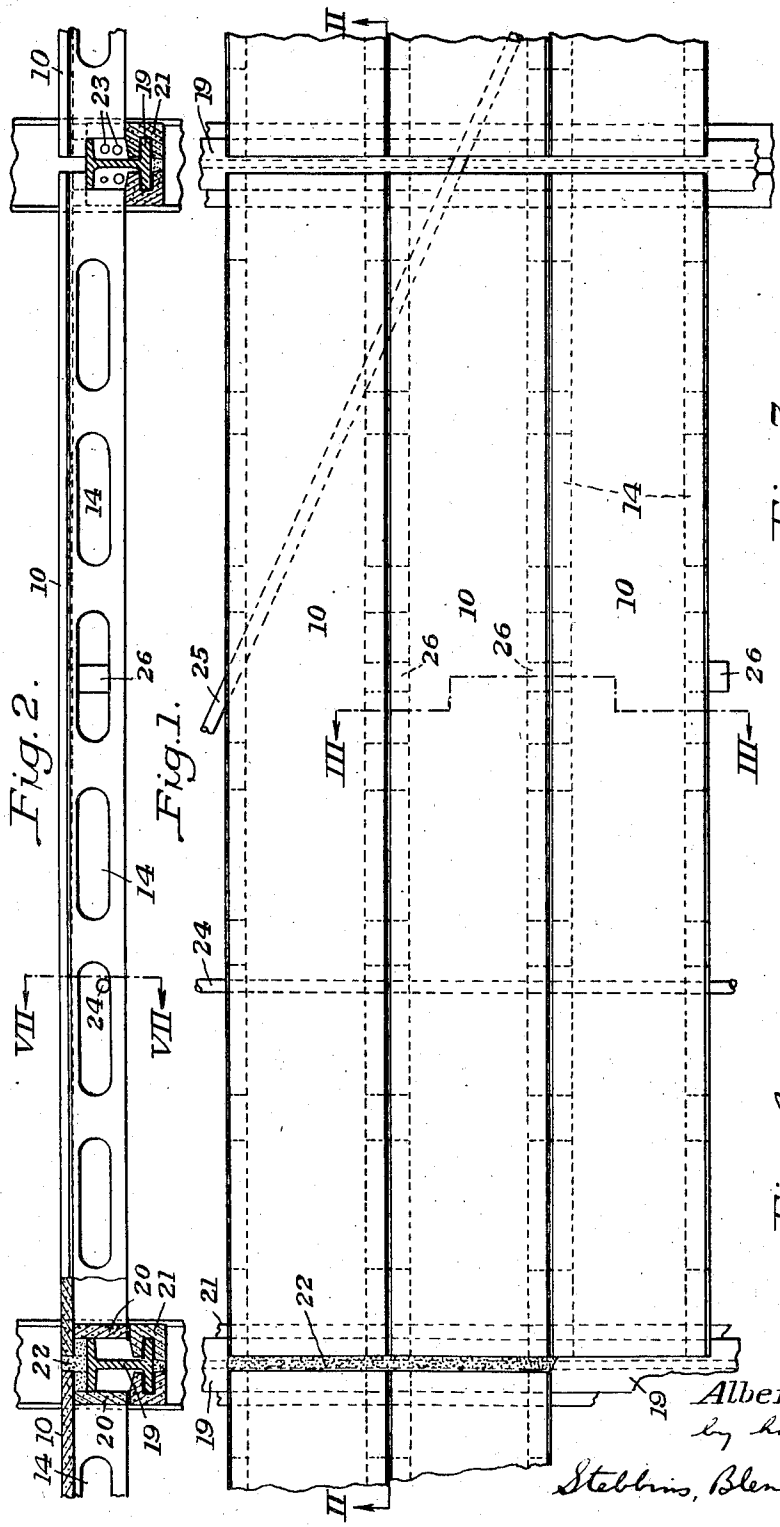

Fig. 1.

Fig. 2.

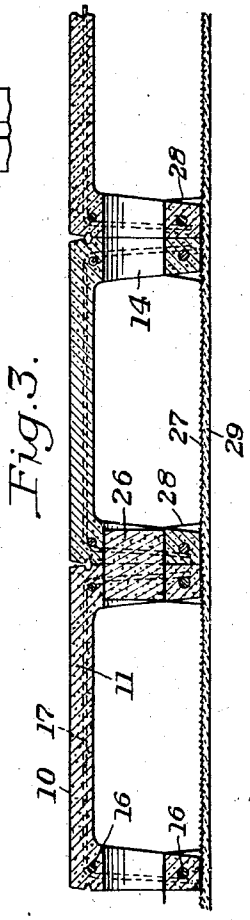

Fig. 3.

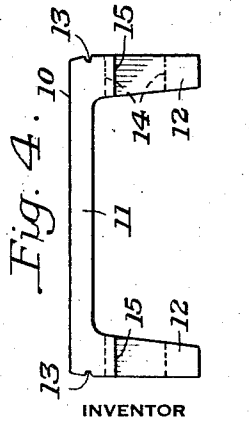

Fig. 4.

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Aug. 29, 1939. A. HENDERSON 2,171,338

BUILDING MEMBER AND CONSTRUCTION

Filed Sept. 29, 1938 5 Sheets-Sheet 2

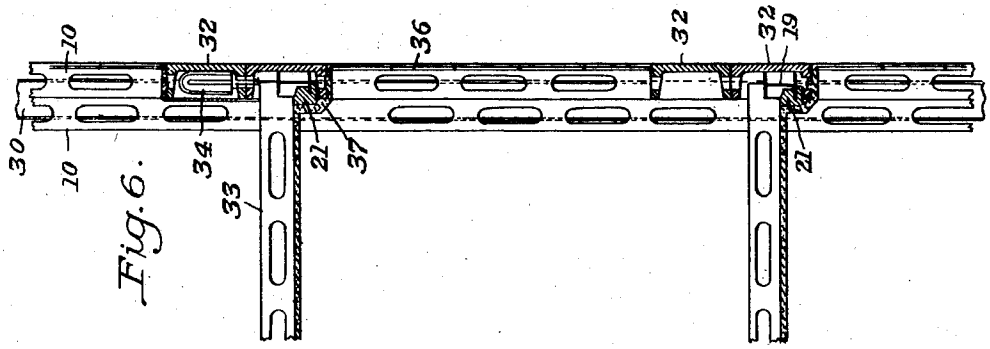

Fig. 6.

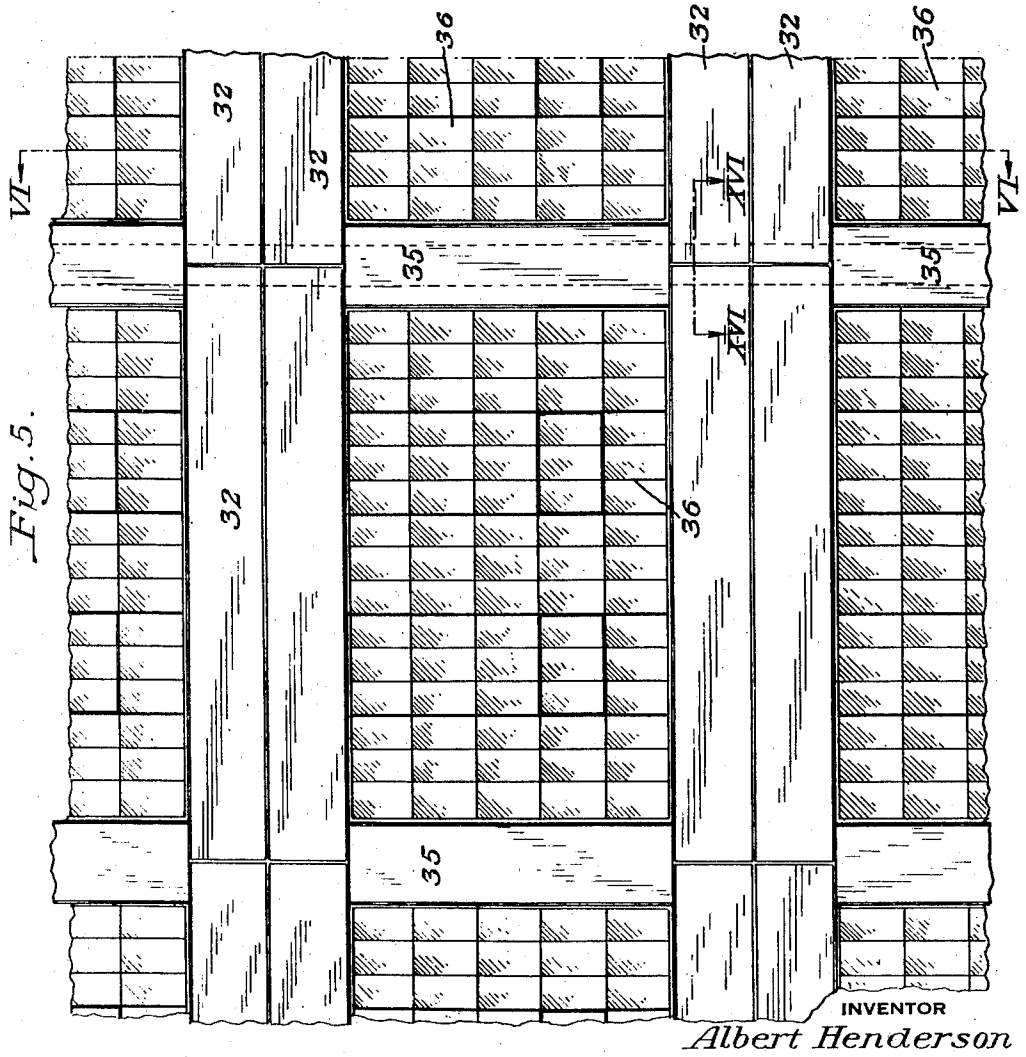

Fig. 5.

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Aug. 29, 1939. A. HENDERSON 2,171,338

BUILDING MEMBER AND CONSTRUCTION

Filed Sept. 29, 1938 5 Sheets-Sheet 3

Fig. 7.

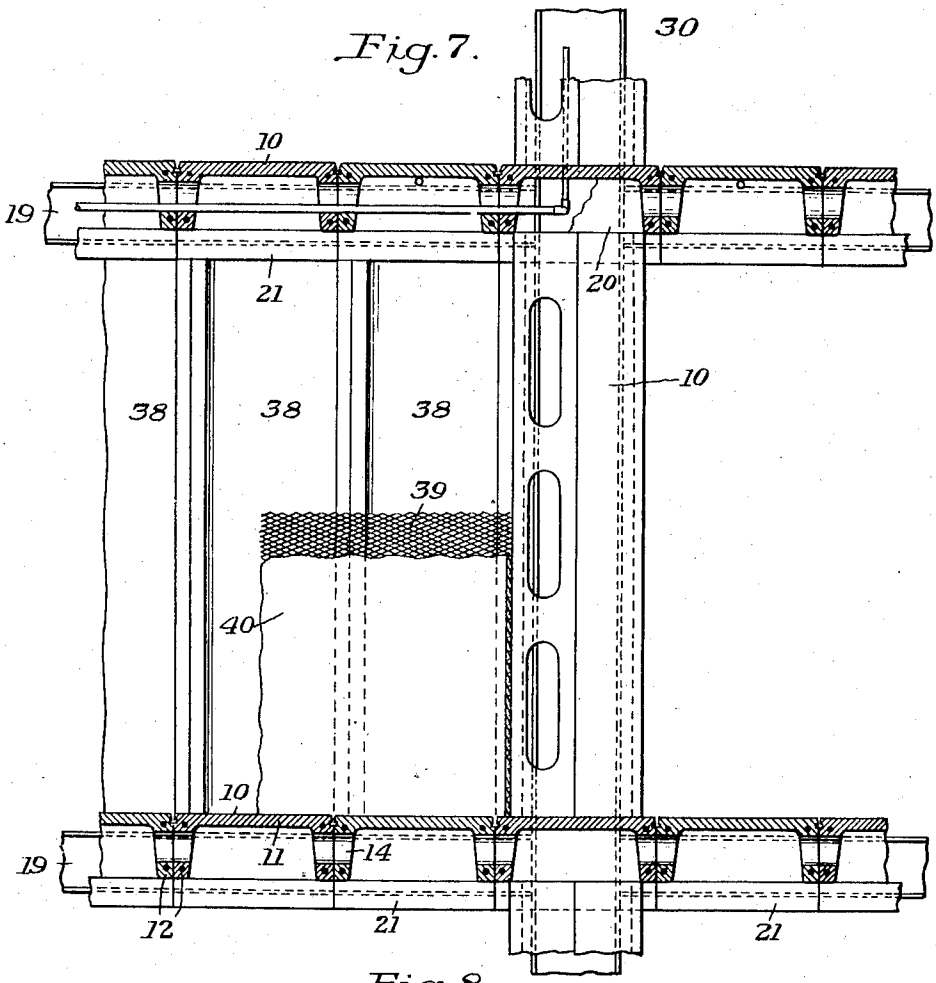
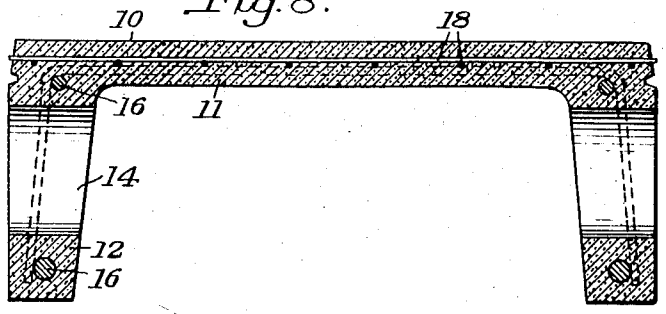


Fig. 8.



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Aug. 29, 1939. A. HENDERSON 2,171,338

BUILDING MEMBER AND CONSTRUCTION

Filed Sept. 29, 1938 5 Sheets-Sheet 4

Fig. 11.

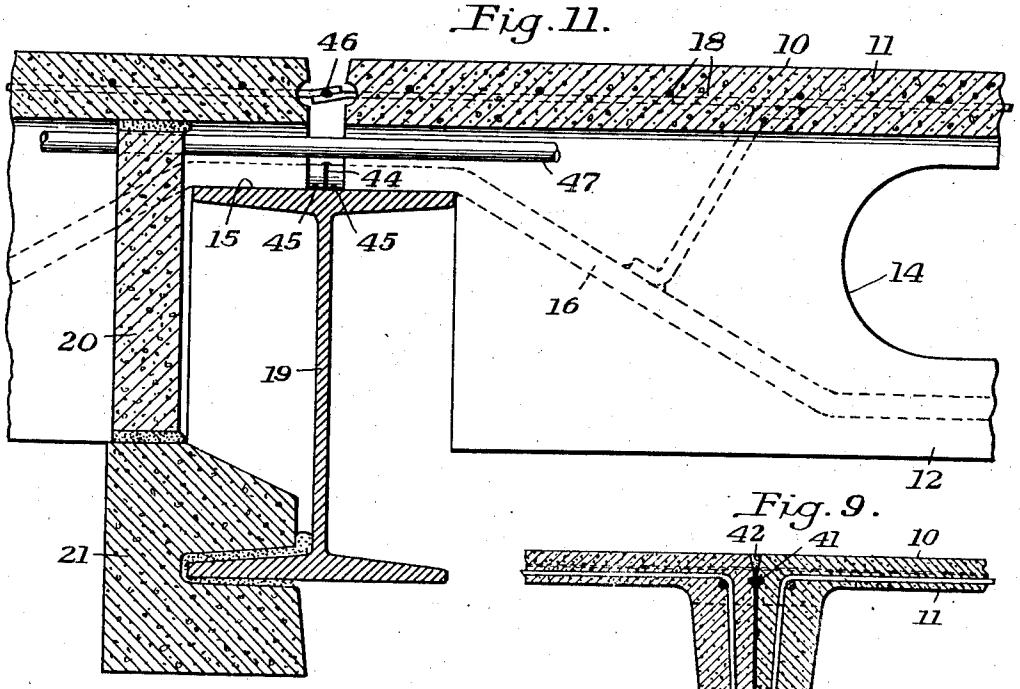


Fig. 9.

Fig. 10.

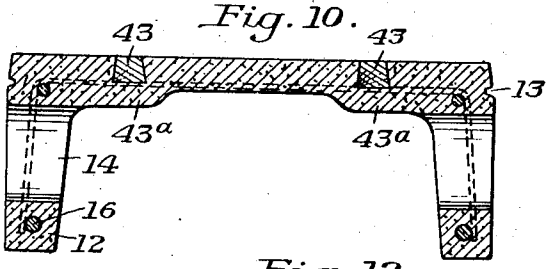


Fig. 13.

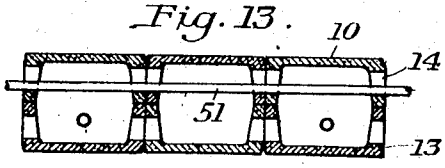


Fig. 12.

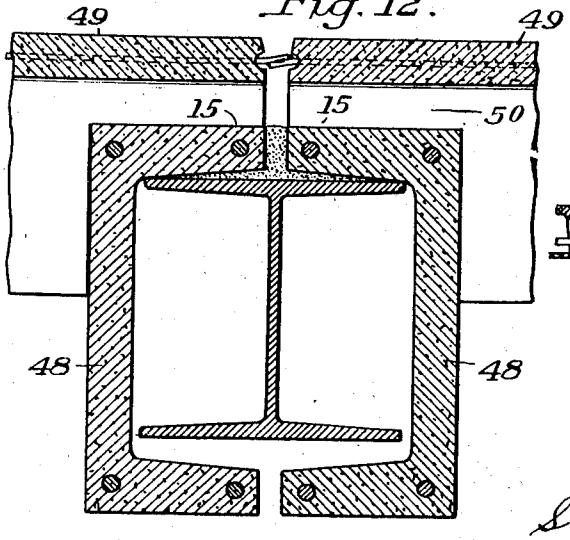


Fig. 14.

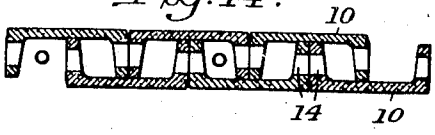
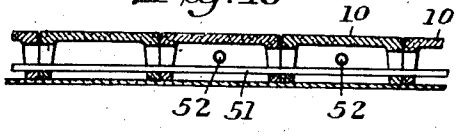


Fig. 15



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Aug. 29, 1939. A. HENDERSON 2,171,338

BUILDING MEMBER AND CONSTRUCTION

Filed Sept. 29, 1938 5 Sheets-Sheet 5

Fig. 16.

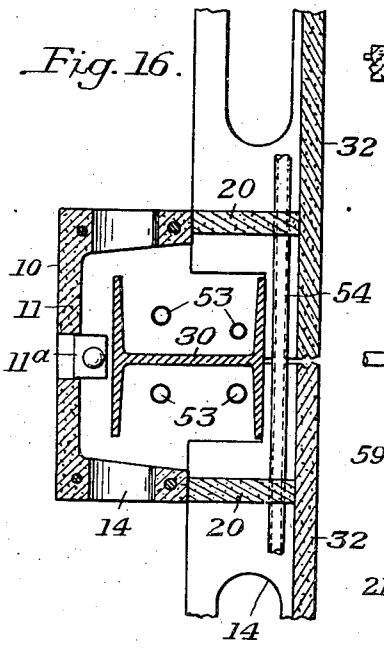


Fig. 19.

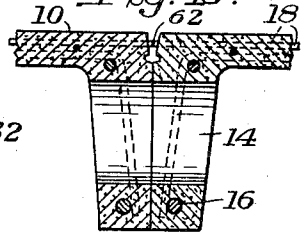


Fig. 20.

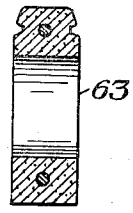


Fig. 21.

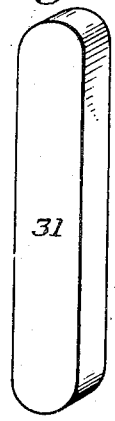


Fig. 18.

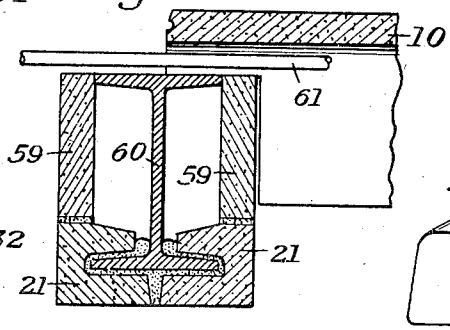


Fig. 22.

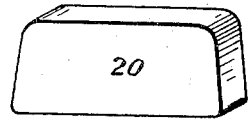


Fig. 17.

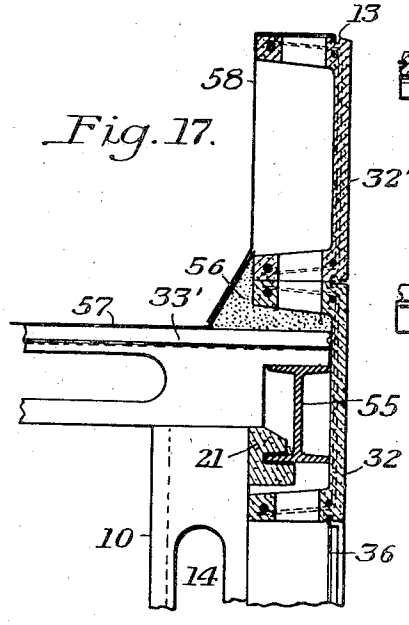


Fig. 25.

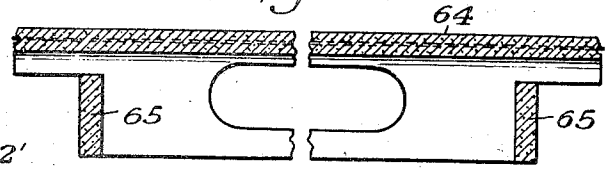


Fig. 23.

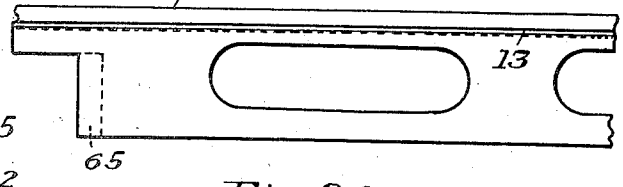
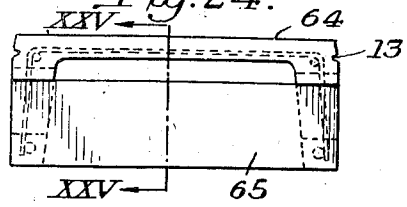


Fig. 24.



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Albert Henderson

by his attorneys

Stebbins, Blenko & Parmelee

Patented Aug. 29, 1939

2,171,338

UNITED STATES PATENT OFFICE

2,171,338

BUILDING MEMBER AND CONSTRUCTION

Albert Henderson, Pittsburgh, Pa., assignor to William P. Witherow, Pittsburgh, Pa.

Application September 29, 1938, Serial No. 232,330

8 Claims. (Cl. 72—1)

This invention relates to a building member and a construction made possible thereby. Particularly, the invention concerns a precast slab-like member preferably of concrete, adapted to serve a variety of purposes in a new form of building construction made possible thereby, to the end that buildings may be erected much more quickly and much more cheaply than at present.

One method of laying the floors in steel frame buildings now widely practiced requires the erection of shoring, the building of forms thereon, the placing of hollow tile on the forms, the distribution of reinforcing bars between the tile, and the pouring of concrete on the form as well as the pouring of a second or finishing layer of concrete to cover any conduits required to be imbedded in the form. This mode of construction is slow and very costly. The pouring of concrete in the field furthermore is dependent on weather conditions and sometimes requires special precautions to avoid freezing. The manner of making provision for the numerous conduits now required in modern building construction is quite a serious problem.

I have invented a building member and a construction which the latter makes possible whereby the aforementioned objections to the previous types of building construction are largely overcome if not entirely eliminated. In a preferred form the invention comprises a precast slab adapted to serve a variety of purposes in the construction of a modern type building, such as floors, partitions, spandrels, coping, roofing, pilasters, etc. The slabs serve as fire-proofing enclosures for the various members of the usual steel building frame. They are of channel section and have elongated slots in their flanges to permit the passage of conduits therethrough in various directions. By the use of these slabs it is possible to enclose a building substantially as rapidly as the steel framework is erected. Further details and advantages of the invention will be brought out in the course of the following description which refers to the accompanying drawings illustrating a preferred embodiment of slab and indicates certain of its uses. In the drawings:

Fig. 1 is a partial plan view of a floor composed of the slabs of my invention;

Fig. 2 is a sectional view taken substantially along lines II—II of Fig. 1;

Fig. 3 is a sectional view taken substantially along lines III—III of Fig. 1;

Fig. 4 is an end view of the slab;

Fig. 5 is a partial side elevation of a building constructed by the use of the slab of my invention;

Fig. 6 is a sectional view taken substantially along the lines VI—VI of Fig. 5;

Fig. 7 is a sectional view taken substantially along the lines VII—VII of Fig. 2 except that it shows two floors;

Fig. 8 is an enlarged transverse section through the slab;

Fig. 9 is a partial transverse section through a pair of slabs disposed in side-by-side abutting relation and illustrating the manner of sealing the joint therebetween;

Fig. 10 is a transverse section through a slab having nailing strips incorporated therein;

Fig. 11 is a partial longitudinal section through a pair of slabs disposed in end-to-end relation and resting on a supporting beam;

Fig. 12 is a similar view illustrating a modified construction;

Fig. 13 is a horizontal section through a partition composed of my slabs;

Figs. 14 and 15 are similar views illustrating modified forms of partitions;

Fig. 16 is a sectional view taken substantially along the lines XVI—XVI of Fig. 5;

Fig. 17 is a transverse sectional view through the roof and coping of a building embodying the invention;

Fig. 18 is a view similar to Fig. 11 illustrating a modification;

Fig. 19 is a view similar to Fig. 9 showing the manner of connecting the reinforcing members imbedded in the slabs;

Fig. 20 is a transverse section through a fractional slab for piecing out odd widths;

Fig. 21 is a perspective view of a filler block adapted to be inserted in the flange openings on the slabs in cases where it is desirable to present a closed continuous surface;

Fig. 22 is a similar view of a filler block adapted to be disposed at the end of the slab;

Fig. 23 is a partial side elevation of a modified form of slab;

Fig. 24 is an end view thereof; and

Fig. 25 is a sectional view taken substantially along lines XXV—XXV of Fig. 24.

Referring now in detail to the drawings, a slab 10 comprises a web 11 and flanges 12. The flanges are grooved longitudinally as at 13 and are provided with elongated openings 14. The flanges terminate short of the ends of the slab providing shoulders 15 adapted to rest on the flanges of supporting beams.

The slabs 10 are preferably precast of suitable

material such as concrete and are provided with longitudinal reinforcing bars 16 and transverse reinforcing bars 17. The webs of the slabs furthermore have a reinforcing mesh 18 (see Fig. 8) imbedded therein. The slabs may be made up in standard widths and lengths.

A convenient width is 30''. A length of 20' will be found most convenient for general application although slabs may be made in any length. It should be stated, however, that the full advantage of the invention may best be realized by applying the slabs to fairly long spans for which their design makes them acceptable, in order to eliminate the necessity for intermediate supports.

Figs. 1, 2 and 3 illustrate the use of the slabs to provide a floor. As there shown, the slabs are disposed side by side in abutting relation with their shoulders 15 resting on the upper flanges of spaced beams 19 forming part of a building frame. Filler blocks 20 (see Fig. 22) are disposed within the flanges of the slabs at each end thereof. The lower flanges of the beams 19 are enclosed within the fireproofing channels or shoes 21 which are also precast from concrete or similar material, in standard lengths. The joints between the channels 21 and between the latter and the filler blocks 20 are mortared and the space between the ends of the long slabs above the beam is filled with grout as at 22. The space adjacent the beam is left clear for conduits as illustrated at 23. The elongated openings 14 also facilitate the insertion of conduits through the floor as indicated at 24 and 25. Because of the length of the openings 14, the conduits may be disposed at oblique angles to the slabs as well as parallel and perpendicular thereto.

Blocks 26 extend through certain aligned openings 14 in adjacent slabs and are mortared therein whereby to distribute the load applied to any individual slab to the adjacent slabs. Because of the channel section of the slabs, and the reinforcement thereof as shown, they can be designed to carry substantial loads over considerable spans. A smooth ceiling may easily be provided by suspending metal lath 27 from the slabs by ties 28 and plastering thereover as shown at 29.

Figs. 5, 6 and 7 illustrate the use of the slabs as spandrels or sills and lintels, pilasters, mullions, and column fireproofing as well as flooring. A pair of slabs 10 disposed about a column 30 with their flanges in abutment provide a fireproof enclosure therefor. The openings 14 of slabs used for column fireproofing are closed by filler blocks 31 (Fig. 21) mortared in place. Before being closed, they afford hand holes for working on the conduits enclosed by the slabs. Alternatively, the openings may be omitted from the slabs to be used for column fireproofing. Figs. 5 and 6 show slabs 10 serving as spandrels 32. The upper or sill spandrel 32, because of its channel section, provides a suitable recess for radiators, indicated at 34. The slabs 10 also serve as pilasters 35 extending between adjacent spandrels. As shown in Fig. 5, the pilasters support the spandrels 32. The grooves 13 in the slabs serving as pilasters and spandrels define a continuous recess for receiving the edge of metal window sash 36. As a result of this construction, the exterior of the building is composed of large panels of glass divided by broad horizontal bands of concrete and narrower vertical bands, thus conforming to the modern architectural trend. The interior of the building is plaster finished as indicated at 37, thereby concealing the flanges of the spandrel slabs, the fireproofing channels 21, and the bottoms of the floor slabs. It will be noted in all the forms of construction shown herein that the steel building frame is completely enclosed by fireproof members which may be of the thickness required to conform to building codes.

Fig. 7 further illustrates the ease with which conduits may be placed in the floor and within the fireproofing enclosure for the columns. It also illustrates the use of slabs extending vertically from floor to ceiling as shown at 38 to form partitions. Metal lath may be tied to the edges of the slab flanges as shown at 39 and plastered as at 40 to provide a smooth finished partition.

Fig. 9 illustrates the manner of closing the joints between adjacent slabs. Tar or mastic is poured into the joint as shown at 41 and when it has cooled, the joint is filled with grout as at 42. This type of joint is used between floor slabs as in Fig. 1. The joints between slabs laid horizontally such as spandrel slabs 32 are perfectly sealed by an asphalt strip laid therebetween. The groove formed by the beveled edges of abutting slabs is then pointed to complete the seal. The joints between the abutting ends of the spandrel and pilaster slabs may be similarly sealed.

Fig. 10 illustrates a slab similar to that of Figs. 1 through 4 except that nailing strips 43 are imbedded in the web of the slab to facilitate nailing thereto a floor or other sheathing, and that portions 43a are thickened.

Fig. 11 shows how the longitudinal reinforcing bars 16 of the slabs may be welded together as at 44 and to the supporting beams as at 45. The longitudinal members of the mesh 18, furthermore, may be permitted to protrude beyond the ends of the slab for welding together as at 46. This manner of construction ties together the slabs on opposite sides of a supporting beam.

Fig. 11 also shows how conduits may be passed over a beam. A conduit 47, for example, passes through a filler block 20 which is notched to receive the conduit, and thence over the beam and into the space within the flanges of the aligned slab.

Fig. 12 shows a modified form of beam fireproofing composed of slabs 48 similar to the slabs 10. In this construction the floor slabs indicated at 49 rest on the upper flanges of the slabs 48 composing the beam fireproofing. The slabs 48 will naturally be made without the holes 14 in their flanges. It will be noted in Fig. 12 that the shoulders 15 of the slabs 49 provide a clear space 50 for the reception of conduits over the beam.

Fig. 13 illustrates a modified form of partition composed of pairs of slabs disposed with their flanges in abutment. The openings 14 in the slabs permit the passage of conduits therethrough as shown at 51.

Fig. 14 illustrates a different form of partition in which the flanges of one slab engage the web of two oppositely disposed overlapping slabs.

Fig. 15 shows a partition similar to that illustrated in Fig. 7.

The ease with which conduits may be extended through the several forms of partitions will be apparent, horizontal conduits being shown at 51 and vertical conduits at 52.

Fig. 16 is a horizontal section showing the complete enclosure for the columns 30 provided by the spandrel slabs 32 and an inner slab 10, the flanges of which engage the flanges of the spandrel slabs and the filler blocks 20 inserted

therein. Fig. 16 also shows how conduits 53 may be positioned adjacent the columns and within the enclosures therefor. Similarly, horizontal conduits 54 may be positioned within the spandrel slabs by notching the filler blocks 20 to admit them. Metal boxes 11a may be set in suitable holes to receive lighting fixtures.

Fig. 17 is a detail of the roof construction of a building embodying the invention. As there shown, roof slabs 33¹ rest on a girder 55. The lower flange of the lower or lintel spandrel slab 32 rests on pilasters such as those shown at 35 in Fig. 6. Sheet metal or other sheathing 57 is laid on the roof slabs 33¹. A smooth surface for the interior of the upper or coping spandrel 32¹ may be provided by a panel 58 of sheet metal or the like, the upper edge of which laps the upper edge of the slab and is seated in the groove 13 thereof.

Fig. 18 shows a modification according to which the filler blocks 20 are replaced by continuous slabs 59 which close the space between the channels 21 and the beam indicated at 60. This leaves a clear space for the passage of a conduit 61 over the beam.

Fig. 19 shows how the transverse members of the reinforcing mesh 18 may be welded together as at 62 further to tie adjacent slabs together.

Fig. 20 shows a fractional slab 63 which is relatively narrow and serves the purpose of filling out the fractional portions of the width of a room too small to accommodate a full-sized slab 10. The slab 63 has openings 14 like those of the slab 10.

Figs. 23 through 25 illustrate a modified form of slab 64 which is similar to the slab 10 except that it has integral end walls 65 which replace the filler blocks 20 and the continuous slabs 59.

When the slabs are used for column fireproofing they may be bolted or otherwise tied together. It may prove desirable, furthermore, to omit the groove 13 from the slabs to be used for this purpose.

Instead of welding the longitudinal reinforcing members of the slabs to the beams as shown in Fig. 11, the ends of the reinforcing bars may be threaded and inserted through lugs welded to the beams and secured thereto by nuts threaded on the bars. The arrangement of the reinforcing bars 16 relative to the mesh 18 as shown in Fig. 11 constitutes a truss for each flange of the slab.

It will be apparent that the invention is characterized by numerous advantages over present building practice. In the first place, the speed with which a building may be erected is greatly increased. In fact the building may be enclosed substantially as rapidly as the steel work is erected. The slabs forming the floors and other parts of the building may be handled by the same derrick which is used in the erection of the steel. By laying the floor slabs as soon as the steel is in place I avoid the necessity for temporary wood planking which is required by building codes for safety reasons on the upper floors while the erection of steel thereabove continues.

It is also possible to eliminate external steel beams between adjacent columns since the spandrel slabs have very high strength and may be welded to the external columns or bolted thereto.

The welding of the reinforcing members of aligned slabs ties the entire floor system together and eliminates the usual secondary beams tying the columns together.

The erection of a building utilizing my invention may proceed regardless of freezing weather conditions and since the building is enclosed substantially as rapidly as the frame is erected, the interior work can be started much sooner and the over-all building time materially reduced.

Floors made in accordance with the invention, furthermore, are lighter than ordinary reinforced concrete floors and this makes possible a saving in the size of the frame members themselves. Since the slabs are precast, there is no difficulty with shrinkage of the members after installation.

The possibility of introducing conduits in the floors, partitions and wall slabs is a highly important advantage. Air conditioning ducts may also be disposed between the slab flanges.

Partitions may be formed of the slabs by setting them either horizontally or vertically as may be most convenient under the circumstances. When the slabs are used as spandrels, the beveled edge thereof facilitates the drainage of rain water away from the sash groove. The slabs which are used as portions of the exterior wall may readily be provided with an insulating layer bonded to the inner side of the slab web. The exterior of the slabs may be faced with ornamental glass, tile, or other finishes of various types or colors. The floor slabs furthermore may have wood, mastic, or terrazo finishes applied thereto before delivery to the building site.

While the slabs are chiefly useful in connection with steel frame buildings, there are many places where they may also be used in buildings without steel frames.

Although I have illustrated and described a preferred embodiment and certain modifications of the invention, it will be understood that changes in the construction and arrangement may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, and a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, the ends of the reinforcing projecting beyond the ends of each slab and being welded to the girders on which the slab rests.

2. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, and a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, the ends of the reinforcing of longitudinally alined slabs resting on a common girder projecting beyond the ends of the slabs and being welded together.

3. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, and spandrel slabs similar

to said floor slabs extending between adjacent columns and being braced thereby at each end.

4. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, spandrel slabs similar to said floor slabs extending between adjacent columns and being braced thereby at each end, said spandrel slabs being disposed in vertically spaced relation, and pilasters extending between vertically spaced spandrel slabs, said pilasters being composed of slabs similar to the floor and spandrel slabs and forming part of a fireproofing enclosure for said columns.

5. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, and a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, the ends of said flanges being recessed providing shoulders adapted to engage said girders and position the slabs with their lower faces above the girders whereby conduits may extend between the slabs and girders, and holes spaced along said flanges whereby conduits may extend transversely therethrough.

6. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, a floor composed of a plurality of precast reinforced cementitious slabs of channel section, each having flanges and a web, disposed side by side with their flanges extending downwardly and with their ends resting on adjacent pairs of said girders, and fireproofing enclosures for each column composed of a pair of slabs similar to said first-mentioned floor slabs, said pair of slabs being disposed about said column with their flanges abutting, resting on said floor, and extending in single length upwardly to the slabs of the floor above thereby completely enclosing said column.

7. In a building construction, a standard structural steel frame including columns and girders extending between adjacent columns and supported thereby, and a floor composed of a plurality of precast reinforced cementitious members disposed side by side with their ends resting on adjacent pairs of said girders, the ends of the reinforcing projecting beyond the ends of each member and being welded to the girders on which the member rests.

8. In a building construction, a structural steel frame comprising columns and beams and a floor composed of a plurality of precast cementitious members disposed side by side and supported on the beams, the cementitious members having reinforcements therein, which reinforcements have end portions projecting from the cementitious members and lying adjacent one another between adjacent slabs, such ends being welded together.

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